ISSN (print) 0093-4666 © 2013. Mycotaxon, Ltd. ISSN (online) 2154-8889

MYCOTAXON

http://dx.doi.org/10.5248/123.467

Volume 123, pp. 467–472 *January–March 2013*

A new species of *Cantharomyces* (*Laboulbeniales*, *Ascomycota*) from the Netherlands

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Abstract — This paper describes and illustrates *Cantharomyces elongatus* sp. nov., a parasitic fungus from *Syntomium aeneum* (*Staphylinidae*, *Oxytelinae*, *Euphaniini*). *Syntomium* is a new host genus for *Cantharomyces*. Comments on its position among related taxa are given.

Key words — insect-associated fungi, morphology, taxonomy

Introduction

Laboulbeniales are obligate ectoparasitic ascomycetes that live associated with arthropods, mostly insects. At present the order comprises about 2050 species in 140 genera (Rossi & Santamaría 2012). Systematic and taxonomic contributions are available for several countries in western Europe and North America.

The genus *Cantharomyces* Thaxt. includes 28 species (Tavares 1985, Huldén 1983, Majewski 1990, Rossi & Santamaría 2000), characterized by a receptacle consisting of three superposed cells, a compound antheridium subtending a simple or variably branched primary appendage, and a perithecium having four to five cells in each vertical row of outer wall cells (Thaxter 1931, Majewski 1994). Detailed information on *Cantharomyces* and its morphology and position among other *Laboulbeniales* is given in Thaxter (1890, 1896, 1908, 1931), Tavares (1985), Majewski (1990, 1994), and Santamaría (2003).

The host range of *Laboulbeniales* on *Staphylinidae* and other *Coleoptera* has been studied by Frank (1982), who listed 17 *Cantharomyces* species. In addition to *Staphylinidae*, *Cantharomyces* species have been reported from *Dryopidae*, *Limnichidae*, and *Hydrophilidae* (Tavares 1985). Based on recent taxonomic insights in *Staphylinidae* from Newton & Thayer (2005) and Bouchard et al. (2011), four tribes of the *Staphylinidae* are host to *Cantharomyces*: *Bledíini*

and *Oxyteliini* (subfam. *Oxytelinae*), and *Aleocharini* and *Oxypodini* (subfam. *Aleocharinae*) (Thaxter 1890, 1896, 1908, 1931, Sugiyama 1973, Frank 1982, Huldén 1983, Tavares 1985, Majewski 1990, 1994, Rossi & Santamaría 2000, Santamaría 2003).

This paper presents a new species of *Cantharomyces*, collected from a staphylinid beetle belonging to a fifth and so far unreported host tribe.

Materials & methods

The host was found by sifting soil from an ash forest on clay. Infected material was dried, pinned, and identified by O. Vorst (using Lohse 1964). Screening for infection and removal of thalli was done at 50× magnification. Thalli were transferred with insect pin 0 and embedded in Amann solution (Benjamin 1971). Cover slips were ringed with transparent nail varnish. Both insect specimen and the examined microscope slides are deposited at the National Herbarium of Belgium (BR). Drawings and measurements were made using an Olympus BX51 light microscope with drawing tube, digital camera and AnalySIS Five imaging software (Soft Imaging System GmbH). Differences in the proportions of basal cell and suprabasal cell were analyzed using the ratios R_L = length basal cell / length suprabasal cell and R_W = width basal cell / width suprabasal cell. Average ratios are given for adult thalli, including minimum and maximum values in parenthesis.

Host taxonomy follows Newton & Thayer (2005) and Bouchard et al. (2011).

Taxonomy

Cantharomyces elongatus Haelew. & De Kesel, **sp. nov.** Plate 1

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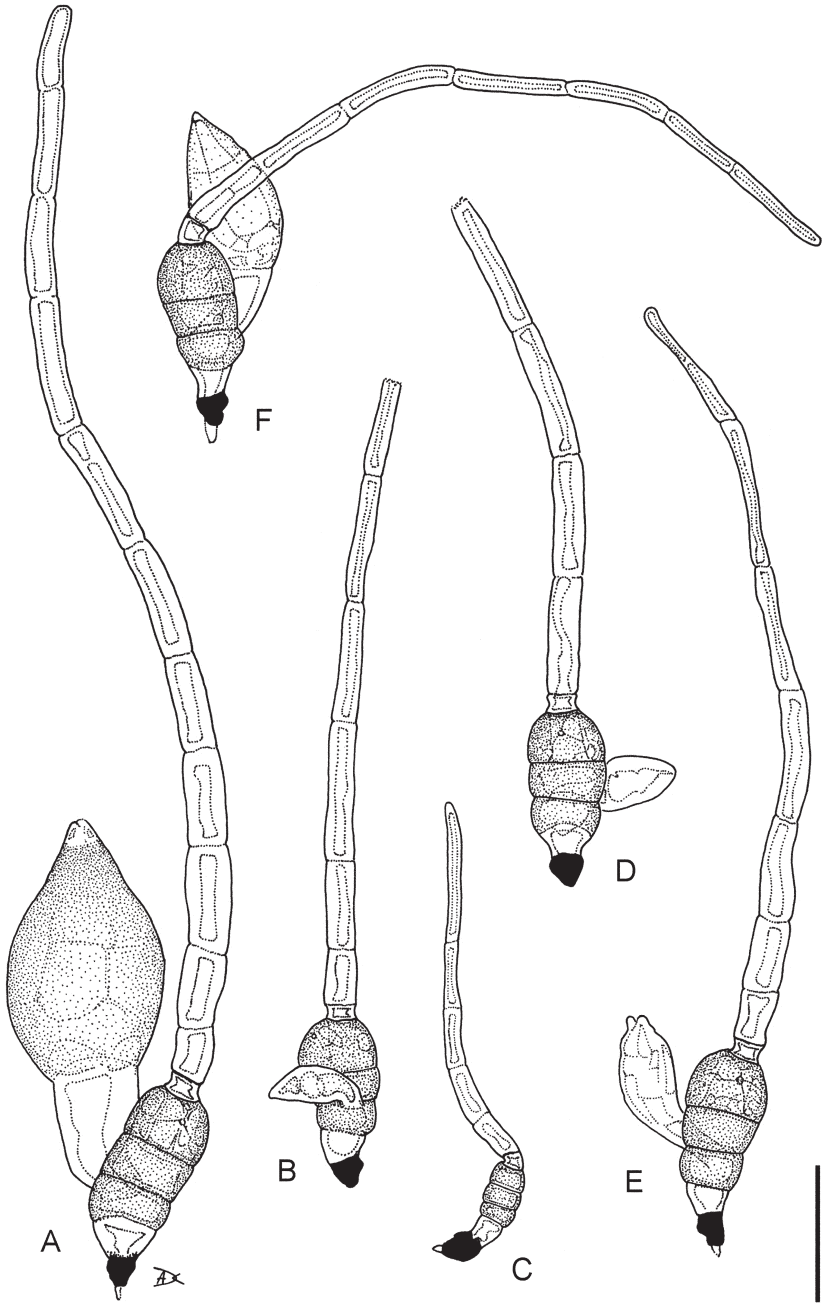
Differs from *Cantharomyces orientalis* by its single long, strictly unbranched, straight primary appendage with the basal cell > 2.5× longer and wider than the suprabasal cell.

Type: The Netherlands, Prov. Gelderland, Rha, 52°02.9′N 6°08.5′E, on *Syntomium aeneum* (Müller, 1821) (*Coleoptera*, *Staphylinidae*, *Oxytelinae*, *Euphaniini*), 13 Oct 2001, leg. O. Vorst, slides Haelewaters 69a (**holotype**, 2 mature and 4 immature thalli, found on left elytron and abdominal tergites, BR MYCO 173753-26), Haelewaters 69b (**isotype**, 1 mature and 2 immature thalli found on elytra, BR MYCO 173752-25), and Haelewaters 69c (**isotype**, 2 mature and 2 immature thalli found on elytra, BR MYCO 173751-24).

Etymology: from the Latin adjective *elongatus* = elongate, referring to the long, unbranched primary appendage.

Thallus 145–175 µm long from foot to perithecial apex. Receptacle 50–60 µm long, cell I obtriangular, 22–30 µm long, cell II and cell III with similar shape, slightly pigmented, not blackened, broader than long, cell III somewhat longer than cell II. Primary appendage composed of a basal cell, a small

Plate 1. *Cantharomyces elongatus* from *Syntomium aeneum*. A. Mature thallus from elytrum (holotype Haelewaters 69a). B–D. Immature thalli with perithecial primordium (holotype slide Haelewaters 69a). E. Immature thallus (isotype slide Haelewaters 69b). F. Submature thallus (isotype slide Haelewaters 69c). Scale bar = 50 µm.


A
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suprabasal cell and a series of elongate cells. Basal cell of primary appendage in the same axis as cell II and III, apically convex, slightly more pigmented than or concolorous with cells II and III, 23 × 30 µm (length × width), basal septum with cell III straight. Suprabasal cell relatively flattened and small [R_L = 2.88 (2,77–3,17), R_W = 2.81 (2,58–2,96)], 6.5–10 µm long, trapezoidal, slightly constricted, supporting a straight, 300–415 µm long unbranched series of 7–11 hyaline, thick-walled, elongate cells of 25–40 µm each. Antheridium located around a central core in the basal cell of primary appendage, with subapical opening on the latter's posterior side. Perithecium 72–96 × 40–57 µm, ovoid, symmetric, widest in the middle, tapering upwards, moderately pigmented; apex pointed, hyaline, poorly differentiated. Cell VI born laterally on cell II, 41–47 × 22–30 µm, hyaline. Ascospores not seen.

Additional specimens examined: **THE NETHERLANDS, Prov. Utrecht,** Utrecht (Amelisweerd), 52°04′N 5°09′E, on *Syntomium aeneum*, 11 Nov 1990, leg. O. Vorst, slides Haelewaters 145a (1 damaged thallus from right elytron, BR MYCO 173750-23) and Haelewaters 145b (3 immature thalli found on prosternum, BR MYCO 173749-22).

Discussion

Cantharomyces elongatus is easily recognized by its very long and unbranched primary appendage with a relatively large basal cell and small trapezoidal suprabasal cell. Most of the time, even in a dried state, this long structure is found undamaged, indicating its robustness. In many genera of *Laboulbeniales* damaged appendages are known to regenerate in an erratic or at least atypical way. Among all examined specimens of *C. elongatus* we found several thalli with a normally regenerated, i.e. unbranched, appendage. Atypical regeneration of the appendage may be infrequent in this taxon since we found only one specimen with a bifurcate regenerated appendage (on its fourth appendage cell). Whenever a branched or aberrant appendage is seen in this taxon, one should look carefully for traces of damage to the appendage.

Cantharomyces elongatus was found on the pronotum, elytra, and abdominal tergites and does not seem to be morphologically variable on these different regions.

Cantharomyces elongatus is related to *C. orientalis* Speg., a very variable species having a primary appendage that is ramified above its suprabasal cell. Occasionally, however, *C. orientalis* bears a more or less short, unbranched appendage. In such cases, *C. orientalis* can still be easily distinguished from *C. elongatus* by its proportionally longer and wider suprabasal cell. In *C. elongatus* the basal cell is at least 2.5× longer and 2.5× wider than the suprabasal cell. Based on data from Belgian material and illustrations in Santamaría 2003 and Majewski 1994, this proportion is significantly smaller for *C. orientalis*, R_L = 1.33 (0.85–1.96) and R_W = 1.24 (0.95–2.16). The combination of the appendage

characteristics of length, branching, and relative height of the suprabasal cell should be enough to separate *C. orientalis* from *C. elongatus*.

Moreover, although *C. elongatus* and *C. orientalis* parasitize staphylinids from the same subfamily (*Oxytelinae*), they infect hosts belonging to different tribes: *C. elongatus* infects hosts of tribe *Euphaniini* and *C. orientalis* hosts of tribe *Oxytelini*.

Cantharomyces robustus T. Majewski shows many differences from *C. elongatus*: the blackening on the dorsal side of cell II, the ramified, shorter appendage, the inflated and rounded basal cell of the appendage (with antheridium), as well as large perithecial basal cells.

The new species is easily separated from the *Cantharomyces* species with an unbranched primary appendage: *C. bordei* F. Picard, *C. denigratus* Thaxt., and *C. italicus* Speg., based on the extreme length and construction of its primary appendage. *Cantharomyces bordei* has an unbranched, but short primary appendage. Furthermore, it is reported from *Limnichus* spp. (*Coleoptera*, *Limnichidae*) and exhibits a very short and constricted cell VI as well as a relatively massive perithecium (124–130 µm long, Santamaría 2003). *Cantharomyces denigratus* and *C. elongatus* seem to share a similar organization of the antheridium (see Fig. 18a and d in Santamaría 2003). *Cantharomyces denigratus*, however, has a deeply pigmented receptacle. *Cantharomyces italicus* has a relatively long primary appendage but its antheridium is different, i.e. lens-shaped, small and laterally positioned within a more elongate basal cell of the primary appendage.

Cantharomyces numidicus Maire, as well as the very similar *Cantharomyces japonicus* K. Sugiy., differ in having a relatively large antheridial segment and a dissimilar arrangement of its primary appendage's basal cell (Thaxter 1931, Santamaría 2003).

Cantharomyces elongatus parasitizes *Syntomium aeneum*, extending the known host range of *Cantharomyces* to the staphylinid tribe *Euphaniini* (subfam. *Oxytelinae*).

Acknowledgments

The authors are indebted to Dutch entomologist Oscar Vorst for putting the host specimen and its identity at our disposal. Thanks are also due to Sergi Santamaría and Donald H. Pfister for reviewing the manuscript. We wish to express our gratitude to Cyrille Gerstmans for technical support and the Uyttenboogaart-Eliasen Foundation for financing part of this research.

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